

Science and soothsaying

Published originally in the International Herald Tribune
December 28, 2007

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Now that the Bali conference is over and climate scientists have warned us again about the dire predictions of their climate models, a question remains: Will their forecasts come true? Given the current international focus on global warming, you would think that, in 10, 15 or 20 years, many people will want to know whether today's predictions proved accurate.

But, in fact, people rarely look back to see if their old forecasts were on the mark. Foretelling the future has always been difficult and almost always wrong. Charles Mackay, in his wonderful 1841 book "Extraordinary Popular Delusions and the Madness of Crowds," observes that the so-called necromancers of earlier centuries who purported to divine the future were grouped with the worst alchemists. Today, however, computers seem to have undermined our natural skepticism. Many of us put our faith in complex software that most of us cannot understand.

My own experience makes me skeptical of how environmental forecasting is being used. In 1991, several colleagues and I drew national and international attention when we used a computer model to forecast possible effects of global warming on an endangered species. Our computer program forecast that the Kirtland's warbler, the first songbird in America ever subjected to a complete census, would likely face extinction by 2010. Its habitat, jack pine trees, would be unable to thrive in conditions that climate computer programs forecast for southern Michigan, the only place and only trees where the bird nested.

The computer told us these declines should be measurable even in the year we made the forecast. We suggested that measurements of jack pine growth be started to verify the forecasts and to see whether the potential effects of global warming on the diversity of life were actually occurring. People could have started going to southern Michigan to check out our forecasts 16 years ago. Nobody did. I tried to get funding to do this, but no government agency or private foundation was interested.

Even today, amid the furor over global warming, no one is rushing out to verify that it does indeed threaten the Michigan jack pine. (But, happily, independent action by the government, the Audubon Society and private individuals has brought the Kirtland's warbler back from the brink of extinction.)

What could explain the lack of interest in verifying a dated computer forecast? After all, computer forecasts are the basis for the current alarm. Did people perhaps decide that a 16-year-old forecast had to have been based on inferior methods?

But wait a minute. Given the usual progress of science, won't forecasting methods in the future always be better than in the past? What this suggests is that today the primary uses of, and interest in, such forecasts are political, not scientific - that scientists as well as politicians are using forecasts for political and ideological purposes to influence public behavior here and now.

The question is not really whether the forecasts are scientifically valid, but how much impetus they can provide to influence society.

It wasn't always this way. In the 1960s, when research into global warming was just beginning, it seemed impossible that people could change the global environment; the Earth was just too big. Charles Lyell, the father of modern geology, considered the possibility in detail in the mid-19th century and decided it was impossible because the mass of living things amounted to less than a drop in the bucket compared to the weight of all the materials in the oceans, atmosphere, soil and rocks.

In the 1970s, however, scientists began to realize that life had in fact greatly changed the Earth's environment, starting more than a billion years ago. At the same time, evidence was building that burning fossil fuels was increasing the atmospheric concentration of carbon dioxide. In 1957, Charles Keeling began the first continuous measurements to study carbon-dioxide change over time at Mauna Loa, Hawaii. By 1973, he reported at a landmark conference at Brookhaven National Laboratory on "Carbon and the Biosphere" that carbon dioxide showed a definite increase in 15 years, consistent with releases from burning fossil fuels. For those of us working on these issues, the scientific and environmental implications were vast.

Global environmental change began to become a political issue in the 1980s. Climatologists and astrophysicists showed that a nuclear war could put so much dust in the air that disastrous cooling would occur, the infamous nuclear winter. With the end of the Cold War, the focus shifted to global warming. At that time, climatologists explained that their computer models were crude approximations of the real atmosphere and pushed the limit of computer technology, requiring months of computing for a single simulation. You could accept either the results of these crude models or the less-formal projections by the most experienced meteorologists. The primary focus continued to be on the implications of what we knew.

In 1988, in a move that marked a shift to the politicization of forecasts, Congress asked the Environmental Protection Agency to report on the potential effects of global warming. Computer forecasting became much more complex; output from the huge climate models became input into ecological models. My projection for the little warbler was part of that work. The attempt was to be more realistic, but the result was that forecasts became more difficult to verify and also more alarming, thus drawing more and more public attention.

Thinking over this history, I see three primary uses of environmental computer forecasts: to understand the implications of what we know (Can living things change the global

environment?); to know the future; and to influence public behavior. Only the first can be strictly scientific. The third is wandering farther and farther away from science.

Since proving the validity of long-term forecasts is difficult and the ultimate tests would take years, and since many scientists are alarmed at the dire scenarios, my colleagues are beginning to talk about whether it is O.K. to exaggerate and push forecasts that are not currently provable if the only way to get societies to act is to frighten people. I think it is not O.K. It is a short-term view, and even if it works, it will inevitably debase science and scientists.

Soothsayers have always tried to persuade people that they could predict the future. What is new today is that the incredibly powerful tools of science - nuclear weapons, flights to the moon, computers, iPods - have such huge implications for civilization that they may contain the seeds of their own destruction.

Thirty years from now, we will probably not be interested in today's specific computer forecasts, but we may have lost our faith in science, a deeper and, to me, a more important problem.
